Proceeding Paper

The Antecedents of Household Acceptance on Food Waste Innovation Products in Terengganu [†]

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†   Presented at the International Academic Symposium of Social Science 2022, Kota Bharu, Malaysia, 3 July 2022.

Abstract: Food surpluses or waste materials may be transformed into new commercial products that aim toward food conservation. It is desirable to investigate the household level of knowledge and attitude towards acceptance of food waste innovations products. A total of 213 returned surveys are analyzed with the descriptive statistical and one-way ANOVA. It shows that knowledge and attitude are the antecedents of the acceptance on food waste innovation products. The findings might help minimize the amount of food waste produced on a daily basis by encouraging consumers and businesses to turn food surpluses or waste into useful items and a source of revenue.

Keywords: food surplus; food waste; food innovation products

1. Introduction

The worldwide waste crisis is becoming worse every day. According to a World Bank statement issued in 2019, there has been a 70% rise in worldwide urban solid waste, with emerging nations experiencing the greatest issues. The forecasted increase in waste volume from 2.01 billion tons per year currently to 3.40 billion tons per year by 2050 is expected to increase world expenses from USD 205 billion to USD 375 billion per year [1]. A surprising fact showed that around 1.3 billion tons of the world's entire food production is wasted each year [2]. In Malaysia, food wastes account for 32% of total waste, followed by paper and plastics, which account for 21% and 14% of waste, respectively [3]. Food waste production is predicted to rise dramatically in the future years, while landfill space is becoming scarce. Additionally, the findings from Solid Waste Management and Public Cleansing Corporation (SWCorp) presented that the total amount of food waste can definitely fill up the twin towers up to 16 times by 2020. Another fact was that Malaysians' waste is about 16,688 tons of food per day, which is an amount that can feed around 2.2 million people three times a day [4].

Food waste has become a world concern because it has had an impact on the environment as larger amounts of food are generated to meet the demand from an increasing and more affluent population [5]. Due to the increasing food waste, humans face serious environmental challenges such as global warming, increasing world population, overrun of solid waste materials and environmental pollution [2]. Food waste also contributes to the development of greenhouse gases in landfills. Food waste in landfills releases toxic substances in the soil that cause negative consequences for groundwater [6]. The act of shifting food waste from solid waste landfills to the recycling process is believed to contribute significantly in reducing greenhouse gases, making the earth a better place to live. Through near daily clean-up efforts around the city, the Kuala Terengganu City Council

(MBKT) gathers 300 tons of solid waste and transports it to a landfill in Sungai Ikan (Kuala Terengganu). Cleaning and solid waste collection operations in the city, which covers an area of 4291.31 hectares, are budgeted for MYR 7.75 million each year. Furthermore, cleaning and collection of solid waste on Pulau Redang costs MYR 557,280 per year, including solid waste transportation from the chalet to the mainland [7].

Furthermore, food-wasting is mainly high among consumers from an economic perspective. The data shown by [8] has stressed that Malaysian households of five have to spend an average of MYR 900 a month on food only. Meanwhile, a quarter of that food is wasted during preparation, cooking, and usage. This point has indicated that about MYR 225 goes into the bin every month, which works out to MYR 2700 a year per household. The data found in 2016 showed that food waste contributes to wastage, in which the Food Aid Foundation (Food Aid) documented that Malaysian food wastes almost 15,000 tones, including 3000 tons of edible food every day [9]. Besides this, food waste impacts social perspectives whereby it cannot be accepted as, in fact, there are still many people who live in hunger. An estimated 795 million hungry people out of 7.5 billion people living in this world suffer from starvation and chronic malnutrition [10]. Moreover, food security issues arise with the losses related to food access, such as food prices and purchasing power [11]. Food waste is a growing problem and its disposal is controversial, causing food prices to rise and access to food sources at high prices [12].

Food wastage mostly comes from the consumer level at surprising percentages and rates. Household waste, which includes food waste, paper, plastic, rags, metal, and glassware, is one of the most common sources of Municipal Solid Waste in populated neighborhoods [4]. Food waste from residential as well as commercial establishments such as restaurants, institutions, industries, school cafeterias, hospitals, and factories can actually be recycled [13]. In line with the above notion, several researchers are already engaged in the opportunities of using food waste to create new, value-added products that can be implemented to reduce food wastage. Furthermore, the importance of innovative advances in preventing or reducing food waste has been highlighted [14,15]. Food waste innovation is one of the solutions that can be made and accepted by society because of the flow of garbage that turns food waste into a reusable commodity. The extremely huge amount of wastage has drawn the attention of researchers to look for an alternative of utilizing food waste by-products [15]. Therefore, utilizing food waste innovation products not only helps the economics of residential and community, but can also increase food sustainability and reduce food insecurity, especially for underdeveloped countries [7,14–16]. In line with that, it is important for the study to identify the antecedents of acceptance on food waste innovation products which are knowledge and attitudes among Household in Kuala Terengganu.

2. Literature Review

2.1. Food Waste among Household

Malaysia is well known for being a foodie's paradise, with a wide variety of cuisine readily available at all times. Food is inextricably linked to Malaysia's identity and to the belief in warm hospitality among Malaysians. This stated declaration is most evident during the festive season such as the Hari Raya celebration, Chinese New Year, Deepavali and Gawai celebration, as people gather to celebrate with plenty of food. Unfortunately, this distinct culture and ideology has also been giving rise to household waste, since the amount given is frequently in excess of what is required. As a result, SWCorp discovered that, during the festive season, food waste might increase by up to 50% than usual [17]. Furthermore, according to Hayati Ismail, Director of the Food Aid Foundation, household waste is the leading source of food waste, followed by 'pasar malam' (night markets) and Ramadan bazaars, garbage from food courts, and finally the food and beverage [18].

Chronically, the average Malaysian discards 1.64 kg of waste each day, compared to 1.2 kg globally [8]. Households account for the majority of the country's daily food waste of 16,650 tones. Additionally, according to the data by SWCorp, households generated

the most food waste (38%) compared to wet markets (24%), restaurants (23%), and hotels (23%). Overbuying food, poor food storage, and a lavish lifestyle are the primary causes of food waste [4]. The unconsumed food waste includes rotten fruits, expired bread, and eggs have doubled over the past three years and these could be a contributing factor to food waste issues in Malaysia [19]. Due to this, the use of food waste innovation products in the food industry seems to be a solution since it is not only caused by overabundance of waste among household level, but also by the depletion of renewable resources, the limitation of land available for agriculture, and the continual expansion of the world population [16].

2.2. Antecedents of the Acceptance on Food Waste Innovation Products

Knowledge may be characterized as a discrete outcome of acquiring and improving learning, with the knowledge being discrete until the individual uses it to complete a task, make a choice, or solve an issue [20]. Planning and purchasing routines, having or not having a stock overview, and not knowing if food may still be consumed are all factors that influence consumers' food management knowledge [20]. There are still 36% of consumers who are confused about the date labeling, which is the 'best before' date vs. the 'use-by date,' which might lead to food being thrown away unnecessarily [8]. Furthermore, consumers who have a strong understanding of the issues that would develop as a result of food waste are more inclined to avoid wasting food [13]. In keeping with this, when consumers have a high level of knowledge about the topic at hand, they are more likely easier to interpret the information and tend to accept something. As a result, having more knowledge has helped to better information processing, and it is a good preparation to accept innovations in food waste [7].

Attitudes are defined as "learned predispositions to respond consistently favorably or negatively toward a particular object" [21]. Consumers' acceptance of the effectiveness of innovation products were shown to be related to their degree of knowledge [16]. If education fails to enhance people's knowledge level, their attitudes do not alter or improve toward desired ones. However, attitude is a psychological evaluation that hinders the food waste reduction, and if some of the consumers have positive knowledge and attitudes, the acceptance for innovations will increase [7,13]. On the basis of previous elaboration in the literature review section, the proposed research framework is shown in Figure 1 below:
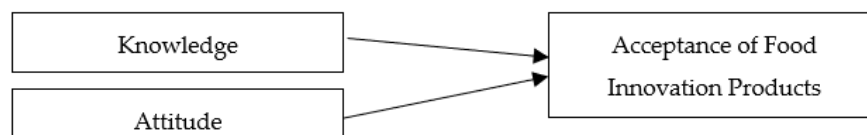

Figure 1. Research Framework.

3. Materials and Methods

This study is conducted to discuss the antecedents of acceptance on food waste innovation products among households. The convenience sampling approach was used in this study, with households randomly selected among the Kuala Terengganu population. The target population in this study is households in Kuala Terengganu, since this study seeks to determine public acceptance of food waste innovation products. Food waste is higher in urban areas due to a disparity in resident socioeconomic backgrounds. On the other hand, a household is defined as one or more people living in the same residential area, such as an apartment, a mobile home, or any single inhabited room [22]. All of the respondents are classed as household since they are assumed to reside in a house and produce municipal solid waste. The total population of Kuala Terengganu is estimated to be around 186,100 people, with a land area of 20,776 hectares [23]. However, due to time constraints and based on rule of thumb, only a total of 250 questionnaires were distributed to respondents. However, out of 250 questionnaires, only 213 surveys were completed and returned with accurate and significant results. PB Square, Plaza Paya Bunga, Pasar Payang, and Kuala Terengganu Express Bus Terminal were the selected areas in Kuala Terengganu.

The study calculated respondent information based on a questionnaire that has four sections: Section (A) demographic characteristics of respondents, Section (B) degree of knowledge, Section (C) consumer attitude, and Section (D) acceptance of food waste innovation products elements. Items in the questionnaire that show strongly disagree (1), disagree (2), neither agree nor disagree (3), agree (4), and highly agree (5) were interpreted using a 5-point Likert scale. Before the actual data collection, the questionnaire was subjected to a pre-test for content validity by experts. This test involved three experts who evaluated the statements' clarity, the questionnaire's presentation, and the acceptance of the statements among the respondents. Changes were made after receiving feedback from experts. After the questionnaire was amended, it was delivered to 50 randomly selected respondents in Malaysia for a pilot study. The researchers analyzed the information using IBM SPSS Statistics for Windows, version 26 (IBM Corp., Armonk, NY, USA) [24]. This study made use of descriptive statistics as well as correlation analysis.

4. Results and Analysis

The respondents' demographic factors are distributed into five categories. Most respondents are females with 64.3%, while the other 35.7% are males. Additionally, both categories' respondents are in the age groups 18–23 years and 24–54 years, and have the majority standing at 49.8% and 49.3% respectively, followed by the lowest respondents age groups of 55–64 years and 65 years and above, which are both at 0.5%. With respect to the respondents' income, it is as expected that the household income collected displayed by 51.2% of respondents is less than MYR 2500 as the majority, followed by 23.0% of respondents earning household income between MYR 2500 and MYR 4849, 16.9% of respondents earning household income between MYR 4850 and 10,959, and the lowest percentage of respondents' earnings of household income is MYR 10,960 with 8.9%. Furthermore, majority of the respondents with 43.7% are living in a household of six or more people, 18.8% of respondents are living in maximum of five people per household, 15.5% of respondents are living in maximum of four people per household, 13.6% of respondents are living in maximum of three people per household, 11.3% of respondents are living in maximum of two people per household, and finally, 6.1% of respondents are living alone. Therefore, this shows that majority respondents have families. In terms of educational level, it was found that 39.0% of respondents are Bachelor's degree holders, 31.5% of respondents are Diploma holders, 6.1% of respondents have graduated with a Master's degree, 1.4% of respondents have acquired a Ph.D., 0.9% of respondents are with PMR certificate, and finally, 0.5% of respondents have only acquired a UPSR certificate.

This section displays the mean scores from respondents on their knowledge and attitude on food waste innovation products. Tables 1 and 2 refer to the descriptive statistics for knowledge and attitude on food waste innovation products respectively. According to the findings, respondents had insufficient knowledge compared to their attitudes around food waste innovation items. Table 1 presents the highest mean of 1.4789, representing the knowledge that food waste can be composted into fertilizer and sold, followed by the knowledge that food waste can be innovated in Terengganu (M = 1.3944), food waste can be used as animal feed (M = 1.3615), the consumption of food waste can help reduce the increase in food waste disposal in the state of Terengganu. (M = 1.3427), and lastly, that wasted food can be recycled into innovative products that are beneficial to entrepreneurs or the people of Terengganu (M = 1.3286). The results can be seen as shown in Table 1.

In Table 2, the results provide the descriptive analysis of respondents' attitudes. The results show that the respondents have a high level of attitude on food waste innovation products. The results show the highest mean score of 4.4883 where respondents are concerned about how food surplus waste is collected, transported, and distributed. The lowest mean score is 3.0892, representing estimation of the food portions that can be consumed within a week.

Table 1. Descriptive Statistics of Knowledge.

	N	Mean	Std Deviation
I know food waste can be innovated in our state	213	1.3944	0.4897
I know that the consumption of food waste can help reduce the increase in food waste disposal in the state of Terengganu.	213	1.3427	0.5744
I know food waste can be composted into fertilizer and sold.	213	1.4789	0.5003
I know waste food can be recycled into innovative products that are beneficial to entrepreneurs or the people of Terengganu	213	1.3286	0.4702
I know waste food can be used as animal feed	213	1.3615	0.4817

Table 2. Descriptive Statistics of Attitude.

	N	Mean	Std Deviation
I immediately throw food waste into the trashcan after every meal.	213	4.2207	0.85404
I spend enough time to segregate food waste that can be reused from those that cannot.	213	3.8685	0.90679
I am concerned about how food surplus will be collected, transported, and distributed	213	4.4883	0.70450
I participate in food waste segregation if it's convenient to do it.	213	3.2958	1.16628
I estimate the food portions that can be consumed within a week.	213	3.0892	1.16414

One Way Analysis of Variance (ANOVA) is applied to compare more than two populations and analyze their equality. Moreover, the analysis is conducted to identify whether knowledge and attitude varied accordingly to demographic variables of education level and household income. In this research study, the population involved is divided in terms of respondents' education level, including UPSR, PMR, SPM/STPM, Diploma, Bachelor's degree, Master's degree, and Ph.D. Meanwhile, the group of household income is divided into four groups, namely, B40 (less than MYR 2500 and MYR 2500–4849), M40 (MYR 4850–RM10,959), and T20 (MYR 10,960 or higher). As mentioned in the previous Section 4 equal is defined as when the population shows a significant value greater than alpha value a = 0.05. Therefore, both "attitude and acceptance" factors are analyzed and displayed in Tables 3 and 4 below.

Table 3. Attitude and Acceptance by Education Level—ANOVA results.

		Sum of Squares	df	Mean Square	F	Sig.
Attitude	Between Groups	20.282	6	3.380	8.198	0.000
	Within Groups	84.939	206	0.412		
	Total	105.221	212			
Acceptance	Between Groups	16.021	6	2.670	2.733	0.014
	Within Groups	201.275	206	0.977		
	Total	217.296	212			

Table 4. Attitude and Acceptance by Household Income—ANOVA Results.

		Sum of Squares	df	Mean Square	F	Sig.
Attitude	Between Groups	3.330	3	1.110	2.277	0.081
	Within Groups	101.891	209	0.488		
	Total	105.221	212			
Acceptance	Between Groups	0.260	3	0.087	0.083	0.969
	Within Groups	217.036	209	1.038		
	Total	217.296	212			

Table 3 above shows that an "F" value represents the test statistic's value. The attitude variable shows a higher test statistic value (F = 8.198) with a significant *p*-value of 0.000. The "F" value calculated for the "acceptance" variable is (F = 2.733), and a significant *p*-value of acceptance is 0.014. Based on the analysis, both attitude and acceptance variables show a smaller significance value than the alpha value ($\alpha = 0.05$), which provides that both variables show a different mean population between different education levels.

Table 4 below shows that the "F" value represents the value of the test statistic. The attitude variable shows a higher test statistic value (F = 2.277) with a significant *p*-value of 0.081. Meanwhile, the F value calculated for the Acceptance variable is (F = 0.083), and a significant *p*-value of acceptance is 0.969. From the analysis, both attitude and acceptance variables show a bigger significant value than the alpha value (a = 0.05), hence proving that both variables show equal mean population between different groups of households' income.

5. Discussion and Conclusions

This study focused on investigating the antecedents of acceptance of household on food waste innovation products in Terengganu. Throughout the study, the researchers found that knowledge and attitude have an effect and significant relationship towards the acceptance of household on food waste innovation products, as the increases in those two factors will give a great improvement on how the household would accept the food waste innovation products. However, public knowledge of food waste recycling remains low, and the government should play a vital role in educating the public about the benefits of recycling food waste in preserving the environment and strengthening local and national economies. This study also emphasizes the significance of people's knowledge, as those with a strong understanding are more likely to have a positive attitude since they will think things through before acting. Consumers tend to pay more attention of their present predicament about how food surplus will be collected, transported, and distributed. This is due to the fact that most of the respondents are concerned with the management of food waste disposal (FWD), which can help protect the landfills and reduce wastage in Malaysia. Food waste is the most common type of municipal solid waste created in Terengganu, and if it could be effectively handled, the waste problem may be alleviated. The results are supported by [22], which agreed that people would improve household management behaviors when they realize that food waste innovation products could reduce waste. Aside from that, it can be concluded that the respondents have little knowledge on that food surplus can be composted into fertilizer and sold. Due to this fact, it is important for the community, especially at the household level, to be educated on how food waste can be made into fertilizer with composting methods. In line with this, the innovated waste products could be their business opportunity in Terengganu. In contrast, the households have little knowledge on that food waste can be recycled into innovative products that are beneficial to entrepreneurs or the people of Terengganu. With this fact, the communities and households can be involved to use culinary surpluses from fruits, vegetables, dairy products, or grains in daily activities and can generate their source of income and reduce the amount of wastage produced. Although the respondents who participated in this study do not represent the whole population, the results of this study have provided

useful information regarding the elements that can impact a consumer's decision to not waste food.

Theoretically, the current study expands our understanding of households' knowledge and attitudes, which leads to food waste innovation products, notably among Kuala Terengganu's community and residence. Practically, the new study has significant implications for a variety of stakeholders, including entrepreneurs, society, and governments, in terms of developing a sustainability-oriented food waste by-products and innovation products plan. They may also be able to give more information on the importance of food waste prevention as well as ways for doing so. Practically, along with consumer needs, the food waste processing sectors that produce food waste innovative products will continue to expand across the world. Furthermore, in light of rising environmental concerns, much study is required to determine how food waste might be innovated for value addition and human consumption. This will benefit industry, the environment, and consumers to the greatest extent possible. Not only that, it will also assist the Kuala Terengganu City Council (MBKT) and the Solid Waste Management and Cleaning Corporation in dealing with massive amount food waste from residential houses and household by using innovative ways.

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